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Trend analysis of family-centered care in the neonatal intensive care unit (NICU): A bibliometric study

Family-centered care in the NICU: A bibliometric study

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Abstract
Aim: The study focuses on the analysed trends in FCC practices in NICUs and their effects on neonatal and family outcomes.
Material and Methods: This study conducted a bibliometric analysis of 1,198 peer-reviewed articles from the Scopus database (2000–2025). Publication, citation, H index, and keyword analysis were used to track research developments. Research themes were identified using co-citation analysis and bibliometric mapping (VOSViewer) tools to identify intellectual connections and institutional contributions.
Results: The number of publications by FCC in NICUs (2000–2025) was analysed, and 1,198 publications were found, with the U.S. (2,208), Canada (555), and the UK (250) in corresponding order. With 28 articles, Axelín A is the leading author, and the University of Turku is the leading affiliation (Affiliation with 64 publications). Female (1,163) and infant (799) are the most frequent keywords. From 95 articles, Advances in Neonatal Care emerges as the leading source of information.
Discussion: The results of this study reiterate the growing importance of Family Centered Care (FCC) in NICUs, key contributors, institutions, and journals. FCC improves neonatal outcomes and family well-being while recognizing the need for global collaboration.

Keywords
Bibliometric Analysis, Family-Centered Care (FCC), Neonatal Intensive Care Unit (NICU), Neonatal Outcomes, Co-citation Analysis, Parental Involvement

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Introduction

Family-centered care (FCC) is the healthcare approach that acknowledges the family's role in a patient's normal well-being and recovery, particularly in the neonatal intensive care unit (NICU) [1]. FCC principles respect families' unique needs and culture, empower them to participate in care decisions, and promote open communication [2]. FCC units in NICUs achieve priority rank and focus predominantly on creating a healing environment, which is accomplished by offering private spaces and educating parents [3]. Before the FCC, medical care of children was largely limited to clinical interventions with less consideration of the child's psychological and emotional needs or the child's family. The care process often excluded families, leaving families feeling helpless and disconnected from the child's well-being. FCC grew to include skin-to-skin contact (kangaroo care), shared rounding, and family-led care plans [4]. The Neonatal Intensive Care Unit (NICU) is a specialized hospital unit in which premature newborns, low birth weight, or critically ill newborns are cared for and closely monitored by intensive care [5]. These are units of a controlled environment with life-sustaining technology, stabilizing fragile infants in their most critical weeks or months of life. NICU cares for different conditions, including respiratory distress syndrome, congenital anomalies, infection, and complications of prematurity [6].

Family-centered care (FCC) significantly improves infant outcomes by promoting a nurturing environment that enhances infants' physical and emotional well-being [7]. Strong parent-infant bonding early and sustained helps parents regulate emotions and helps with cognitive growth [8]. Implementation of family-centered care (FCC) in NICUs is a very challenging process. One of the main obstacles is time constraints since NICU staff often work with highly critical sick newborns at a fast pace [9]. Another barrier is staff resistance, which is based on the staff's fear that doing something with families might prevent the family from fully engaging with the clinical workflows or delay critical procedures [10]. The objectives of the study are to identify key developments in the implementation of FCC, evaluate the benefits of FCC to infants and families, identify barriers to the adoption of FCC, and explore institutional and cultural factors that influence the use of FCC to improve FCC practices and inform public policy relating to NICU care.

Material and Methods

Data Resource and Search Strategy

The study was performed using data gathered in the Scopus database, a leading database renowned for its wide and high-quality academic content. The study covers the timespan from 2000 to 2025, a 25-year period covered to track the evolution of FCC practices and get a long-term view of research developments in the field. The articles in the dataset are 1,198 all peer-reviewed journal publications, making these articles credible and relevant. Analysis of this subject revealed a total of 326 unique sources, including journals and books, of which only 232 were published. Most relevant studies were extracted using search terms "family-centered care", "neonatal intensive care", "parental involvement", and "neonatal outcomes". The depth of the research was provided by the advanced bibliometric data from Scopus, such as Keywords Plus (3,445) and Author's Keywords (2,197), allowing us to analyze recurring concepts and emerging trends of this research.

This research strategy directs the choice of articles based on the systematic selection of some of the most influential and thematically relevant publications to obtain a comprehensive and insightful view of FCC trends in the NICU. The number of publications, authors, citations, and publication years had been extracted as key metrics to show research trends and growth. Contributions' impact and academic influence, and their associated institutions, were evaluated using author affiliations and H-index. In addition, the study included references to other countries and regions that contributed their research to evaluate the FCC research globally. To identify leading publications in this field, journals were categorized, and research focus areas were identified through the analysis of keywords, including Keywords Plus and the Author's Keywords.

Bibliometric Analysis

Bibliometric indicators are major in quantifying research trends and academic impact [11]. The volume and influence of research from 2000 to 2025 are assessed using metrics such as the number of publications (NP) and citations (NC). The sample consists of 1,198 articles with an average citation rate, which indicates intensive academic attention. The study is mapped with the help of co-citation analysis, which studies the frequency at which two articles are cited together to study intellectual connections and foundational literature. Further, keyword co-occurrence analysis identifies core themes and research hotspots based on data created using Keywords Plus and 2,197 keywords for those created using Author's Keywords.

Ethical Approval

Since there were no human or animal participants in our study and the study used publicly accessible resources, ethics committee approval was not obtained. There is no personal information provided in this paper.

Results

Overview of Publications on FCC

The study presents an overview on publications related to the FCC in NICU over a 25-year period (2000–2025). 1,198 journal articles were analyzed that showed a strong focus on FCC amongst the academic and clinical research community. There is an obvious trend towards collaborative authorship, where an average of 4.99 co-authors per document indicates interdisciplinary participation. These articles with international co-authorships constitute a global significance of about 15.44% of the articles.

Annual Trends of Publication Quantity

The analysis of the annual trends in the publication quantity on FCC in NICUs shows that there have been steady increases over the years and large increases in the last decade (Figure 1).

Contributions of Countries

FCC research and implementation are dominated by the United States, which also leads with 8992 citations. Other influential contributors include Canada (2,335), followed by Sweden (1,223), which are well cited on average and are ranked in the top 2,000 most cited authors (Figure 1). The global research efforts add Australia (1,059) and the United Kingdom (822). However, countries such as Israel (427) and Portugal (296) have

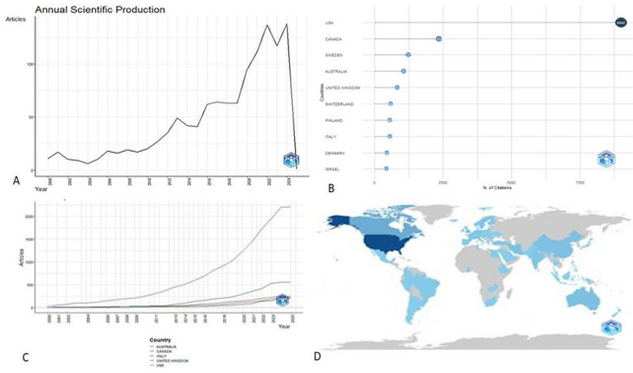

Figure 1. Evalauation of Annual and Country Scientific Productions. (A). Annual Scientific Production (B). Most Cited Countries (C). Country Production over Time (D). Country Scientific Production

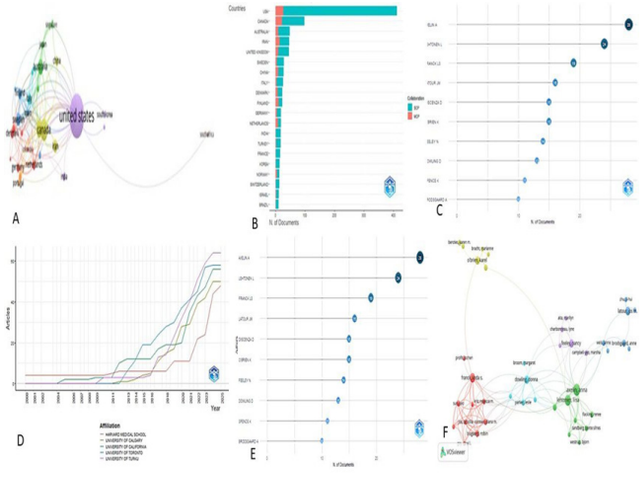

Figure 2. Assesment of Author's activity, relavant affiliations and authors. (A). Network of 19 countries (B). Corresponding Author's Countries (C). Most Relevant Affiliations (D). Affiliation's Production over Time (E). Most Relevant Authors (F). Network of 27 Authors with most Publications

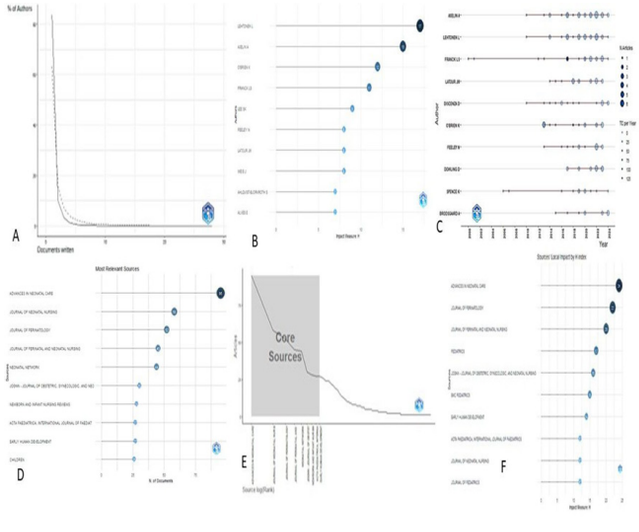

Figure 3. Anlayses of Lotka's Law, H index and Bradford's Law. (A). Author Productivity using Lotka's Law (B). Author's Local Impact by H-Index (C). Author's Production over Time (D). Most Relevant Sources (E). Core source by Bradford's Law (F). Sources Local Impact by H- Index

high citation averages based on a smaller number they produce (Figure 1).

Countries' production over time

The United States shows a strong lead, growing from 24 articles in 2000 to 2,208 in 2025. Canada and the UK also show steady increases, reaching 555 and 250 articles, respectively (Figure 1C). Most corresponding authors are from the U.S., with 412 articles—93.7% being single-country publications (SCP) and 6.3% multi-country (MCP).

Analysis of Affiliations

The results show the importance of leading academic institutions to do research in this sphere, with the University of Turku leading the table with 64 articles, emphasizing its constant contribution to research. The University of Toronto closely follows with 58 publications, confirming its dedication to top-of-the-range academic group effort. The sustained contributions to this area of research are also seen in the University of California (UC) and the University of Calgary, with 56 and 50 articles, respectively (Figure 2).

Performance of Authors

Axelín A leads with 28 articles, indicating significant contributions to the field. Lehtonen L (24 articles), Franck LS (19), and Latour JM (16) are also key contributors (Figure 2). According to Lotka's Law, scientific productivity is inversely proportional to the square of the number of authors [12]. The H-index reflects a researcher's impact, representing the number of publications (H) that have each been cited at least H times [13].

Analysis of Journals

With over 95 publications, Advances in Neonatal Care *stands out as a key journal for high-impact research and innovation in neonatal care, especially in the past decade (Figure 3). According to Bradford's Law, a small core of journals holds most of the field's literature. Advances in Neonatal Care is identified as a core source in neonatal research (Figure 3) [14].

Research Keywords Analysis

In the analysis, frequently used terms such as "female" (1163), "male" (845), "human" (998), and "humans" (839) reflect a strong focus on gender and human-centered care in neonatal research. By 2024, "female" emerged as the most common term, likely due to its link with maternal roles, followed by "human," highlighting the emphasis on person-centered approaches.

Between 2001 and 2010, terms like "neonatal intensive care unit," "infant," and "newborn" dominated, indicating foundational research. After 2010, focus shifted toward "family nursing," "parent," and "child care," with significant growth by 2015, reflecting the rise of family-centered practices.

In the last decade, themes such as "psychological aspects," "social support," and "parent-infant bonding" gained attention, showing an increasing interest in emotional and relational factors. Clinical terms like "oxygen saturation" and "infection control" underline evidence-based care, while the rise of "nursing methodology research" and "adaptive behaviour" since 2015 reflects growing methodological innovation.

By 2023, terms like "infant," "NICU," and "family-centered care" were highly frequent, while emerging themes like "social determinants of health" and "health promotion" suggest a shift toward holistic and professional practices in neonatal care.

Discussion

FCC is a critical approach to healthcare for the neonate in which family involvement in neonatal care improves outcomes for infants and families. The research has been conducted using Scopus, a widely recognised academic database, where 1,198 peer-reviewed articles were analysed, focused on key developments during 25 years. Keywords Plus (3,445 terms) and Author's Keywords (2,197 terms) are used to identify recurring themes in the analysis of 326 unique sources, including 232 published works. Scholarly impact and contributions to global research are shown by global metrics like publication count, citations, and H index. The findings suggest that family-centered care (FCC) is of increasing importance in NICUs as neonatal outcomes and family wellbeing continue to be promoted. Kokorelias et al. (2019) emphasised that the steady rise in publications reflects the global push to incorporate patient and family-centered approaches into healthcare [15]. The rapid increase in publication numbers after 2010 may reflect increased attention to the FCC's contribution to neonatal survival rates and less parental stress. Interdisciplinary research has been facilitated by the trend of collaborative authorship, whereby medical, psychological, and nursing perspectives of FCC research have become integrated [16]. This recognition of the FCC as a priority is highlighted by its global significance as a component of international co-authorship.

Study findings illustrate the worldwide distribution of FCC research in NICUs with strong contributions from the United States, Canada, and many European countries. The research output and citations are led substantially by the United States, due to its extensive healthcare infrastructure and adoption of evidence-based practices. However, that leadership is evidenced by Franck et al. (2023), which demonstrates the critical role that the FCC plays in improving neonatal outcomes [17]. Examples of countries with consistent growth are Canada, Australia, and the United Kingdom, which positively emphasize core neonatal collaborative endeavours. Although MCP percentages, along with high DMP fulfilment and data sharing rates, are also observed in European countries such as Italy, Finland, and Denmark, which resonate with European Union research frameworks that emphasise international partnerships. China, India, and Iran's emerging contributions to the FCC happily highlight its global importance. In particular, studies performed by Sigurdson et al. (2020) highlight the critical importance of further expanding the FCC research in a way that can mitigate disparities and ultimately improve neonatal care in underserved areas [18].

The discussion underlines that academic institutions have the central responsibility to guide the development of research efforts in FCC for NICUs. University of Turku publishes 64 papers and can be recognised as the leader in FCC research, while constantly active in this field since 2017. Research like Weber et al. (2022) established an important position in supporting FCC practices that include parents' engagement as well as neonatal well-being [19]. Likewise, over 58 publications produced since 2013 are indicative of the University of Toronto's commitment to growth and focus on research. However, McManus's (2019) study explains the contribution of the FCC in enhancing emotional support [20]. Both the University of California and the University of Calgary maintain a progressive upward trend in output, which is suggestive of a purposive effort towards enhancing FCC research. Research by Vasli (2018) encourages regional and international collaboration, following research based on FCC's cultural adaptation in various places [21]. They also show that the promotion of FCC mattresses is part of the global academic efforts aimed at the development of FCC knowledge.

Author productivity in FCC research aligns with Lotka's Law, where a few prolific authors contribute significantly. Axelín A leads with 28 articles, followed by Lehtonen L with 24 and an H-index of 17, indicating both quantity and quality. Most authors have only one publication, while a few, like Feeley N and Latour JM, show high impact with moderate output. This concentrated pattern mirrors other specialized fields, highlighting the value of both prolific and occasional contributors for advancing and diversifying FCC research [22, 23].

The findings also demonstrate that key authors in FCC research are both productive and influential throughout time, a mix of prolific and steady researchers. Axelíń A and Lehtonen L have grown to a great extent publications representing leaders in the field. Contributions by authors Franck LS and Latour JM contribute to keeping steady in spite of time and leave us with the sense that the contributions remain sustained at this commitment level to keep advancing FCC knowledge. However, Chen et al. (2019) study analysed how high-impact and cooperative authors contribute to nurturing innovation and keep up research growth in particular narrow subject areas [24]. The findings emphasize the central role of core journals in the field of family-centered neonatal care research outlined by Bradford's Law. Their H-index shows high productivity and impact, and the field is driven by leading journals such as Advances in Neonatal Care, which pump out high output and influence. This is consistent with Scher's (2024) finding, where a small set of key journals dominate in determining the area in which the academics work [25]. The Journal of Neonatal Nursing and Journal of Perinatal and Neonatal Nursing have provided consistently as foundational resources in the care of the neonatal child, advancing clinical and interdisciplinary advancements.

Conclusion

It summarizes the rise of the FCC in NICU over the past 25 years and its results in improving neonatal outcomes and family wellbeing. The result of the bibliometric analysis was a steady increase in the publication of FCC papers, and the United States, Canada, and the United Kingdom being the leading contributors to the global output. Pivotal contributors on the institutional side have been the University of Turku, and on the author side, authors such as Axelín A. Foundational platforms for dissemination of critical FCC research include core journals such as the Advances in Neonatal Care and the Journal of Neonatal Nursing and specialized journals that address niche areas. Keywords that appear most are "female" and "infant," indicative of research areas in family and neonatal health. The importance of the FCC highlights the global significance of interdisciplinary perspectives and the growing global collaborations. However, research efforts are not equally equitable (i.e., underrepresented

regions, disparities in contributions), and so on. This dynamic field is changing, heralding new, innovative, more inclusive ways to provide neonatal care.

Limitation

This study has several limitations. First, relying solely on the Scopus database may have excluded relevant studies from other sources or non-English publications. Second, while the analysis covers 2000–2025, data for recent years may be incomplete, and older records could be underrepresented. Third, the findings likely overrepresent high-income countries and English-language research, limiting global generalizability.

Additionally, fixed search terms like "family-centered care" may have missed studies using alternative terminology. Citation-based metrics also favor established works, potentially overlooking emerging or niche research. While bibliometrics reveal publication trends, they do not assess study quality or clinical applicability. Finally, the focus on prolific authors and institutions may underrepresent smaller contributors.

Despite these constraints, this analysis offers valuable insights into FCC research evolution. Future studies should incorporate multiple databases, broader language inclusion, and qualitative methods to strengthen findings.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and Human Rights Statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or compareable ethical standards.

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Conflict of Interest

The authors declare that there is no conflict of interest.

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